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1325747

THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

May 24, 2005

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APPLICATION NUMBER: *60/566,147*
FILING DATE: *April 27, 2004*
RELATED PCT APPLICATION NUMBER: *PCT/US05/14514*

Certified by

Jon W. Dudas

Under Secretary of Commerce
for Intellectual Property
and Director of the United States
Patent and Trademark Office

PTO/SB/16 (01-04)
Approved for use through 07/31/2006. OMB 0651-0032
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

Express Mail Label No. EL919129030US

INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Rafael	Garcia	Tempe, Arizona

Additional inventors ere being named on the 1 *separately numbered sheets attached hereto*

TITLE OF THE INVENTION (500 characters max)

METHOD TO SYNTHESIZE HIGHLY LUMINESCENT MAGNESIUM DOPED GALLIUM NITRIDE POWDERS

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☑ Specification *Number of Pages* 1
☐ Drawing(s) *Number of Sheets*
☐ Application Data Sheet. See 37 CFR 1.76
☐ CD(s), Number
☑ Other (specify) postcard

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☑ Applicant claims small entity status. See 37 CFR 1.27.
☑ A check or money order is enclosed to cover the filing fees.
☑ The Director is herby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 070135
☐ Payment by credit card. Form PTO-2038 is attached.

FILING FEE Amount ($): $80.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☑ No.
☐ Yes, the name of the U.S. Government agency and the Government contract number are:

Respectfully submitted,

SIGNATURE

Date 4/27/2004

REGISTRATION NO. 24,583 *(if appropriate)*

Docket Number: 9138-0155

TYPED or PRINTED NAME Thomas D. MacBlain

TELEPHONE 602-530-8088

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

PROVISIONAL APPLICATION COVER SHEET
Additional Page

PTO/SB/16 (08-03)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Docket Number 9138-0155

INVENTOR(S)/APPLICANT(S)

Given Name (first and middle [if any])	Family or Surname	Residence (City and either State or Foreign Country)
Fernando A.	Ponce	Tempe, Arizona
Abigail	Bell	Tempe, Arizona

Number 1 of 1

PTO/SB/17 (10-03)
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FEE TRANSMITTAL for FY 2004

Effective 10/01/2003. Patent fees are subject to annual revision.

[X] Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 80

Complete if Known	
Application Number	
Filing Date	herewith
First Named Inventor	Garcia
Examiner Name	
Art Unit	
Attorney Docket No.	9138-0155

METHOD OF PAYMENT *(check all that apply)*

[X] Check [ ] Credit card [ ] Money Order [ ] Other [ ] None

[X] Deposit Account:

Deposit Account Number: 070135

Deposit Account Name: Gallagher & Kennedy,P.A.

The Director is authorized to: *(check all that apply)*

[ ] Charge fee(s) indicated below [X] Credit any overpayments

[X] Charge any additional fee(s) or any underpayment of fee(s)

[ ] Charge fee(s) indicated below, except for the filing fee to the above-identified deposit account.

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	770	2001	385	Utility filing fee	
1002	340	2002	170	Design filing fee	
1003	530	2003	265	Plant filing fee	
1004	770	2004	385	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	80

SUBTOTAL (1) ($) 80

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

	Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		X	=
Independent Claims		- 3** =		X	=
Multiple Dependent					=

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	86	2201	43	Independent claims in excess of 3
1203	290	2203	145	Multiple dependent claim, if not paid
1204	86	2204	43	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($)

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	420	2252	210	Extension for reply within second month	
1253	950	2253	475	Extension for reply within third month	
1254	1,480	2254	740	Extension for reply within fourth month	
1255	2,010	2255	1,005	Extension for reply within fifth month	
1401	330	2401	165	Notice of Appeal	
1402	330	2402	165	Filing a brief in support of an appeal	
1403	290	2403	145	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,330	2453	665	Petition to revive - unintentional	
1501	1,330	2501	665	Utility issue fee (or reissue)	
1502	480	2502	240	Design issue fee	
1503	640	2503	320	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	770	2809	385	Filing a submission after final rejection (37 CFR 1.129(a))	
1810	770	2810	385	For each additional invention to be examined (37 CFR 1.129(b))	
1801	770	2801	385	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($)

SUBMITTED BY				(Complete *(if applicable)*)	
Name (Print/Type)	Thomas D. MacBlain	*Registration No. (Attorney/Agent)*	24,583	*Telephone*	602-530-8088
Signature				*Date*	4/27/2004

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

This collection of information is required by 37 CFR 1.17 and 1.27. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Garcia et al.

Filed: Herewith

Title: **METHOD TO SYNTHESIZE HIGHLY LUMINESCENT MAGNESIUM DOPED GALLIUM NITRIDE POWDERS**

CERTIFICATE OF MAILING BY EXPRESS MAIL
"Express Mail" mailing label number EL919129030US

Mail Stop Provisional Patent Application
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Commissioner:

I hereby certify that the following correspondence is being deposited in the United States Postal Service as Express Mail on the date shown below in an envelope addressed as shown above.

1. Provisional Application for Patent Cover Sheet (2 pages);
2. Fee Transmittal for FY 2004 (1 page in duplicate);
3. Specification (1 page plus cover sheet);
4. Check for $80.00; and
5. A return receipt postcard.

4/27/04
Date

Suzanne Shields
Suzanne Shields

GALLAGHER & KENNEDY, P.A.
2575 East Camelback Road
Phoenix, Arizona 85016-9255
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Fax. No. (602) 530-8500

Express Mail Label No. EL919129030US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Provisional Patent Application

Title: **METHOD TO SYNTHESIZE HIGHLY LUMINESCENT MAGNESIUM DOPED GALLIUM NITRIDE POWDERS**

Inventor(s): Rafael Garcia, Tempe, Arizona
Fernando A. Ponce, Tempe, Arizona
Abigail Bell, Tempe, Arizona

Attorneys for Applicant: Thomas D. MacBlain
Donna H. Catalfio
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2575 East Camelback Road
Phoenix, AZ 85016-9225

METHOD TO SYNTHESIZE HIGHLY LUMINESCENT MAGNESIUM DOPED GALLIUM NITRIDE POWDERS

This invention solves the problem of:

1. Low luminescence efficiency in p-type gallium nitride powders; and
2. Doping and co-doping GaN-powders for electroluminescent devices.

We have developed a new method to produce magnesium-doped gallium nitride powders. This method has a high control over the concentration of magnesium in the final product. The method consists in reacting a gallium-magnesium alloy with ultra-high purity ammonia in a horizontal quartz tube reactor at 1100°C during three hours.

The gallium magnesium alloy is prepared using a mechanical mixer. Ultra-high purity gallium melt and magnesium powder are placed in a stainless steel sealed vessel under vacuum at 300°C and the vessel is mechanically mixed for several hours in order to produce a highly homogeneous alloy.

We have been working on the synthesis of gallium nitride and related compounds as part of a GaN microcrystalline powder project supported by a gift from Durel Corporation (now a division of Rogers Corporation). Professor Fernando A. Ponce and I (Rafael Garcia) planned my second year of postdoctoral stay at Arizona State University (ASU), this second year with the emphasis on learning how to dope such GaN powders. This work is of high scientific as well as technological importance. Durel's gift allowed us to explore directions which were not main stream to current technology. The importance of these powders is in their potential as electroluminescent phosphors. The first stage involved production of GaN powders with high crystalline quality and high light emission efficiency. The second stage involved learning to dope such powders. We started with a new series of experiments using magnesium as an acceptor agent and we found that it is possible to produce magnesium doped gallium nitride powder using a gallium-magnesium alloy as a precursor. Also we found that through this method it is possible to control the concentration of magnesium in the gallium nitride powders. The material produced resulted in surprisingly high Mg-related luminescence.

This invention can be used as a method to produce p-type GaN phosphors that can be used as active material in electroluminescent devices.